JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOL. 10 OCTOBER 4, 1920 No. 16

BOTANY.—*New or noteworthy plants from northwestern Ontario. I.*[1] O. E. JENNINGS, Carnegie Museum. (Communicated by A. Wetmore.)

During the past few years the writer has worked over and named several thousands of specimens from among the collections which were made by Mrs. O. E. Jennings and himself during five summers spent botanizing in Ontario to the north and northwest of Lake Superior.

Among the plants named are several which are believed to be undescribed and a few others which are particularly noteworthy for one reason or another. Rather than wait indefinitely for the final completion of the work of studying and naming the rest of the collections, it is thought best to publish some of the more important items at this time.

Lysias orbiculata var. **pauciflora** Jennings, var. nov.

Leaves broadly elliptic, 6–7 cm. wide and about 14 cm. long, the apex shortly acute; flowers few, about 6, the lip about 14–15 mm. long, and the spur about 2.5 cm. long.

Type collected in spruce-birch woods along the inlet at Magenet Point, near the tip of Black Bay Peninsula, northwest Lake Superior, Ontario, O. E. & G. K. Jennings, No. 4130, August 14, 1913. Herbarium of the Carnegie Museum.

Lysias orbiculata is quite variable as to the size and shape of the leaves and the length of the spur. The common form, which we take to be the typical form of the species, has large round leaves, and the spurs of the flowers are not much longer than the combined length of the pedicel and the ovary. The form here described as var. *pauciflora* presents a combination of differences from the typical form which might easily characterize a species, but because of the occasional occurrence of forms of intermediate character it is thought best to regard it, for the present at least, as a variety.

[1] Published by permission of the Director of the Carnegie Museum. Received May 27, 1920.

Kneiffia depauperata Jennings, sp. nov.

Stems wiry, flexuous, decumbent to ascending or almost erect, 1–1.5 dm. long, moderately appressed-pubescent with fine white hairs, brown, sublustrous, rarely with a few branches; leaves finely appressed-puberulent; rosette leaves 2–3 cm. long, 6–9 mm. wide, spatulate-oblong, rounded at apex, gradually narrowed to a margined petiole; stem leaves mostly bunched in about the middle third of the stem, linear-oblong, about 1.5–2.4 cm. long, 4–6 mm. wide, entire or slightly undulate, rounded to bluntly acute, tapering below into a short margined petiole, light green above, paler below, often strongly tinged with rose-purple; upper part of stem with few or no leaves below the flowers; flowers 1–4 on stem and 1–2 on branches, the floral bracts, if present, similar to leaves, but smaller, usually shorter than the capsule; capsule 5–6 mm. long, oblong-club-shaped, winged on the angles, sparsely glandular-puberulent, tapering below into a pedicel 4–8 mm. long; seeds brown, dull, narrowly ovoid, about 1 mm. long, minutely pitted.

Type growing in matted brownish and partially decayed leaf-remains along the shore of a boulder-strewn bay of the lake northeast of Sioux Lookout, northwestern Ontario, O. E. & G. K. Jennings, Sept. 7, 1914, No. 7,501. Carnegie Museum Herbarium.

This species resembles a weak sprawling specimen of *Kneiffia pumila*, but the leaves are rather strongly appressed-pubescent with fine rather stiff hairs, and the capsules are usually exceeded in length by their pedicels. From *K. linearis* it differs in having the capsules glandular-puberulent and the pedicels longer, the plant having the pubescence distinctly appressed on stem and leaves. *K. depauperata* is perhaps most nearly related to the decumbent plant of the sands of eastern Long Island, *K. Alleni* (Britton) Small, (*Oenothera fruticosa* var. *humifusa* Allen), but the minute pitting on the seeds of the Ontario plant appears not to be in distinct rows, and in shape of capsule also there appears to be a difference.

Pyrola uliginosa var. **gracilis** Jennings, var. nov.

Differing from the typical *Pyrola uliginosa* Torrey in its more slender form, the pedicels longer than the bracts, the veinlets towards the margins of the leaves excurrent into the crenulate teeth.

The leaf blades are about 2.5–3.5 cm. long by 2.1–2.4 cm. wide, varying from emarginate to slightly acute at the apex, rather stiffly membraneous, sub-lustrous to dull, marginally crenulate, at the base gradually tapering into margined petioles which are slender and 3–5 cm. long; scape 2.5–3 cm. high, bearing 5–8 scattered flowers on slender pedicels about 8 mm. long, in the axils of lanceolate acuminate bracts about 5 mm. long; calyx-lobes acute, ovate-lanceolate, about 2.5 mm. long by 1.5 mm. wide just above the base; petals obovate-oblong, obtuse, about 7–8 mm. long, spreading rather widely; anthers about 2.5 mm. long, distally mucronate, the pores terminating short curved tubes,

the filaments dilated below; style slender, declined, curved, about 8 mm. long, the apical collar narrower than the length of the stigma.

Growing in sphagnum moss in a bog near the Indian Mission, south of Fort William, Ontario, O. E. & Grace K. Jennings, No. 1493, July 30, 1912; type consisting of four specimens on one sheet in the Carnegie Museum Herbarium.

Pyrola compacta Jennings, sp. nov.

Perennial with a stiff woody rootstock about 1.5 mm. in diameter, often forking at the apex; leaves forming a rather dense rosette, 5–12 mm. long, leaf-blades broadly oval-elliptic or obovate, abruptly rounded at the base into and acutely tapering into the margined petiole, blades up to 4 mm. long by 3.2 mm. wide, rounded and often apiculate at apex, thin but stiff and sub-lustrous above, the marginal veinlets ending in very fine crenulate teeth; veins fairly prominent, often light colored above and purplish beneath; scape with inflorescence 6–11 cm. high, with usually one bract, stiff, strongly angled; flowers usually six to eight, drooping, borne on pedicels about 2.5–3 mm. long, shorter than the subtending bracts; flowers 12–15 mm. wide; calyx-lobes about 2 mm. long, triangular-ovate, acuminate or acute, a little narrower than long, widest just above the base; petals thick, somewhat concave but widely spreading, veiny, often apiculate, about 7–9 mm. long; filaments dilated below, the anthers usually erect or almost so, with a short curved tube at the proximal end and a slender purplish mucro at the distal end, 6–8 mm. long, often forked; style stiff, declined and curved, the expanded collar usually wider than the length of the stigma; fruit not seen.

A compact rosette plant in a low boggy pasture near Six-mile Lake (Louise Lake), Thunder Cape, northwestern Lake Superior, Ontario, O. E. & Grace K. Jennings, August 20, 1912. Type specimens in Carnegie Museum Herbarium.

This species is unique in its compact form, partly apiculate petals, and long mucronate anthers. Its flowers are very fragrant and in their dried condition indicate that they were probably purplish or rose color. The species resembles most closely *Pyrola elliptica* Nuttall and *P. uliginosa* Torrey.

Pyrola chlorantha var. **revoluta** Jennings, var. nov.

Perennial, with a slender sparsely branching rootstock, the stem above ground short or none, usually caespitose and with rather numerous (5–11) densely clustered leaves; petioles 5–12 mm. long, channeled; leaf-blades rounded-ovate, 1–2.5 cm. long, coriaceous, dull and grayish green above, much paler beneath, glabrous throughout, margins minutely crenulate and closely revolute, veins not prominent, apex obtuse to acute, base rather abruptly narrowed to the petiole; scape with inflorescence 1.2–1.8 dm. high, stiff, usually reddish below, 3–8 flowered, naked or with one bract; pedicels and their bracts about 3–5 mm. long; flowers drooping, about 1.2 cm. wide, light-colored, drying light yellow; calyx 4.5–5.0 mm. wide, the lobes ovate-triangular, rather obtuse

about 1.2 mm wide and long; petals oblong to narrowly obovate, obtuse, 6–7 mm. long, rather widely spreading; filaments dilated below; anthers about 3 mm. long, distally mucronate, light yellow, the tubes nearly 1 mm. long, curved, orange-colored and obliquely porous; style stiff, strongly declined and curved, about 7–8 mm. long, dilated above into a ring wider than the length of the stigma. Fruit not seen.

Growing among huckleberry bushes on the sand of open Banksian pine woods (barrens) at Slate River Station, Canadian Northern Ry., about ten miles west of Fort William, Ontario, O. E. & G. K. Jennings, July 4, 1913, No. 3378. Type consists of three specimens on one sheet in the Carnegie Museum Herbarium.

At first glance the inflorescence suggests *Pyrola chlorantha*, but in the character of the leaves, more or less acute to both ends, the resemblance is rather with the plants known as *P. picta* Smith and *P. dentata* Smith, lacking however, the mottling of the former, and not conspicuously wider above the middle as in the latter. *P. chlorantha* var. *saximontana* Fernald (Rhodora **22**: 49–53, March, 1920) is closely related but appears from a study of a specimen from Leigh's Lake, Wyoming (*Merrill & Wilcox*, No. 1120), to have thicker, more broadly rounded calyx lobes and more deeply colored petals than in var. *revoluta*. The leaves of var. *revoluta* superficially resemble quite closely those of *Pyrola secunda* var. *obtusata* Turcz.

Ledum grœnlandicum Oeder.

Throughout almost the whole region covered in our investigations this plant shows considerable variation, yet the limits of this variation scarcely permit one to subdivide the species even into well-defined varieties. The rather concise description of the North American species of Ledum in Small's treatment in the *North American Flora* (Vol. XXIX, 1919, pp. 36–38) apparently draws the limits of *L. grœnlandicum* too close. Instead of acute or acutish sepals the material from northwestern Ontario has rounded sepals, as indeed has also the material of this species in the Herbarium of the Carnegie Museum from a number of localities from northeastern North America, so that apparently this does not constitute a difference between *L. grœnlandicum* and *L. pacificum* Small. The number of stamens per flower varies indefinitely from 5 to 9, and the capsules vary in the same manner from oval or ovoid to oblong-cylindric, from subacute to obtuse, and from 4.5 to 6.5 mm. long. These limits of variation show a distinct trend in one direction towards *L. pacificum* Small, reported from Sitka and Japan, and a slight trend towards *L. decumbens* (Aiton) Loddiges of more distinctively arctic regions, but there seems to be little indication of any well-defined form or variety in the material thus far studied.

Scutellaria lateriflora Linnæus.

Falls of the English River, Jarvis Lake, Hunt, C. G. Ry., Ontario, O. E. & G. K. Jennings, No. 15,272, August 26, 1917; Black ash swamp at upper end of Pelican Lake, Sioux Lookout, O. E. & G. K. Jennings, No. 7,436, Sept. 5, 1914. Specimens in Carnegie Museum Herbarium.

General Distribution: Newfoundland to British Columbia and south to Florida, New Mexico, and Oregon. Northwards Macoun notes that it reaches Lake Athabasca.

Scutellaria lateriflora var. **axillaris** Jennings, var. nov.

Similar to *Scutellaria lateriflora* Linnæus except that the flowers are single, and in the axils of the large stem leaves, and of the leaves on the slender branches, these latter leaves being ovate and longer than the flowers even at the tips of the branches.

Found in but one locality, a black ash swamp at the upper end of Pelican Lake, Sioux Lookout, Ontario, O. E. & G. K. Jennings, Aug. 18, 1916, No. 11,022. Type in Herbarium Carnegie Museum. Typical *lateriflora* had been found in the same swamp in 1914 and from these the specimens collected in 1916 differ quite markedly in being somewhat larger, much more branched, the leaves of the branches being mainly large like the stem leaves with single flowers in their axils, the ovate leaves being longer than the flowers even towards the tips of the branches.

Stachys palustris Linnæus.

The writer has not seen from North America what he would regard as the typical form of this species, but it seems to be well shown by a specimen studied from Bex, Canton Vaud, Switzerland, Aug. 15, 1887 (Herbier Mouillefarine). In this form the stem is more or less completely covered by a fine and decidedly appressed pubescence, mixed on the angles of the stem with longer stiff and spreading or reflexed hairs. None of the plants found in northwestern Ontario agrees in these characters with the typical form, and there seem to be further differences in the characters of the leaves and flowers also. The *tenuifolia-aspera* type, such as comprises most of the *Stachys* specimens seen from Western Pennsylvania, appears not to be present in the region north and west of Lake Superior, but in that latter region the plants seem best to be regarded as varieties of one widely distributed and variable species, and are perhaps best grouped with the forms described by Rydberg and by Greene (*S. ampla* Rydberg, *S. teucriformis* Rydberg, and *S. scopulorum* Greene) from the western plains and Rocky Mountains of the United States and Canada. The accompanying key will serve to differentiate the three forms found in northwestern Ontario:

Key to *Stachys* in northwestern Ontario.

Bright green; leaves rather sharply acute to acuminate, the larger ones bright green about 8 cm. long by 2 cm. wide, appressed-pubescent above..... *S. palustris* var. *puberula.*

Bright or light green; often decumbent, stem smooth on lower part; leaves obtuse to bluntly acute, smooth above, on flowering stem not over about 6 cm. long by 1.6 cm. wide.. *S. palustris* var. *macrocalyx.*

Whole plant ashy-green; the fine whitish pubescence, more or less glandular-puberulent above; leaves obtuse to bluntly acute, rather finely crenate-serrate, not over 7 cm. long by 2 cm. wide..... *S. palustris* var. *nipigonensis.*

Stachys palustris var. **puberula** Jennings, var. nov.

Angles of the stem with stiff hairs as in *S. palustris* but with the minute pubescence of the sides of the stem loose and spreading and often partly glandular-puberulent.

Perennial, stoloniferous, the stems erect, simple or branched, usually 4–6 dm. high; leaves of the main stem lance-oblong or lance-ovate, the largest in about the middle of the stem reaching a length of about 8–9 cm. and a width of 2–2.5 cm., crenate-dentate, acute at the apex, narrowed to a rounded or obscurely subcordate base, the upper practically sessile, the lower and median with flat petioles from 1–4 mm. long; leaves bright green above, lighter beneath, and with scattering stiff appressed hairs above and spreading hairs at least on the veins beneath; branches often numerous, sometimes arising from the axils of practically every leaf up to the inflorescence about two-thirds of the way up the stem; these branches slender, bearing flowers towards the apex, but especially noteworthy in that the basal and median leaves of these branches are often somewhat oblanceolate and narrowed below to a more slender petiole; inflorescence an interrupted spike up to 2–3 dm. in length having usually 5–6 flowers at each node, the foliose bracts of the lower nodes far surpassing the flowers, the upper lance-ovate and but little if any longer than the calyx; calyx 6–8.5 mm. long, usually densely finely puberulent and with some gland-tipped hairs in addition to the coarser stiffer hairs on the nerves, practically sessile, strongly nerved, the teeth usually purplish, strongly bristly and spinose-tipped and about the same length as the tube and almost erect in fruit; corolla 12–16 mm. long, widely gaping, the upper side and usually the medium portion of the lower lip more or less puberulent outside; the middle lobe of the lower lip about twice larger and longer than the lateral lobes, and considerably exceeding the upper lip; seeds dark brown, obovoid, about 2 mm. long and 1.5 mm. thick, dull.

Type in Carnegie Museum Herbarium, two sheets of specimens collected along the marshy shore of Jarvis Lake, Hunt, Ontario, Can. Gov. Ry., Aug. 19, 1917, O. E. & G. K. Jennings, No. 15052.

The common form of *Stachys palustris* in the black-ash swamps, marshy borders of lakes, and other wet but apparently not boggy (sphagnous) habitats in western Ontario differs considerably from the typical form of the species, in which the stem is more or less completely covered with a fine appressed pubescence, together with which there are on the angles of the stem longer, stiff, spreading or reflexed flowers.

Stachys palustris var. **macrocalyx** Jennings, var. nov.

Erect or decumbent, the base of the stem leafless and more or less swollen, glabrous, sending up erect branches; the upper, or in the decumbent stems, the erect portion of the stem 2–2.5 dm. long, rather weak, smoothish below, above furnished with a fine loose and more or less glandular puberulence mixed on the angles of the stem with sparse, spreading, hispid hairs; leaves oblong-lanceolate, the median 3–5.5 cm. long by 1–1.5 cm. wide, glabrous above, marginally ciliate and with

a few spreading hairs on the veins beneath, thin, shallowly crenate-serrate, bluntly acute, rounded or truncate below into a flattened petiole 1–2 mm. long; leaves on shoots arising from the decumbent or lower part of stem often larger, very thin, sometimes oblanceolate, and more gradually narrowed at the base into a longer (1–4 mm.) and more slender petiole; inflorescence consisting of 5–11 whorls, about 1–1.3 dm. long, lax, the lowest whorls situated in the axils of the upper leaves; calyx more or less black-dotted, campanulate, 7–9 mm. long, sparsely glandular-puberulent and sparsely longer-hispid on the nerves and teeth, the teeth moderately spreading and with somewhat spinose tips; corolla widely gaping, the tube often a little shorter than the calyx teeth, puberulent on upper side, slightly so below, about 13–15 mm. long, the rounded terminal lobe of the lower lip at least twice longer and twice wider than the lateral lobes.

Collected in two places in a black-ash swamp at the east end of Pelican Lake, Sioux Lookout, Ontario, O. E. & G. K. Jennings, Aug. 18, 1914, Nos. 11,031 (type) and 11,015. Carnegie Museum Herbarium.

In four of the five specimens collected, the short erect portion of the stem arose from a somewhat swollen prostrate stem from 3–5 dm. long rooted only at the lower end but presenting the appearance of having wintered under water, and sending up during the following season the terminal flowering shoot and also the axillary larger-leaved shoots from along the stem itself.

Stachys palustris var. **nipigonensis** Jennings, var. nov.

Ashy green in color, with a whitish pubescence; but lower part of stem, axis of inflorescence, and the calices usually more or less purple; stem 3–7 dm. high, simple or rarely branched above, rather slender, covered especially above with a more or less glandular whitish puberulence mixed on the angles of the stem with slender but stiff, jointed, spreading hairs; basal leaves small, linear-oblong to oblong-oval, the median leaves 4–7 cm. long by 0.8–2 cm. wide, narrowly oblong to oval-oblong or oblong-obovate, abruptly rounded to a subcordate base with a short (1–3 mm.) petiole, strongly margined and often with one or two pairs of lateral veins, running independently down to the stem; leaves thin, shallowly crenate-serrate, finely appressed-hispidulous above, below with spreading hairs on the veins, the apex of the lower leaves obtuse, the middle and upper leaves bluntly acute; inflorescence sometimes short, but usually later elongated occasionally reaching a length of 14 cm., widely interrupted below, denser and spicate above, the lowest whorls often in the axils of the comparatively large uppermost leaves; the floral bracts mainly about the same length as the calyx, lanceolate and often reflexed; calyx practically sessile, about 7 mm. long, narrowly campanulate, more or less glandular-puberulent and with stiffer hairs on the nerves and teeth; teeth spreading, two-thirds to three-fourths the length of the tube, narrowly triangular, moderately spinous-tipped; corolla 12–15 mm. long, more or less puberulent and glandular-puberulent on the upper side and somewhat so beneath, widely gaping, the lower lip spotted, the lateral lobes about one-third as wide and one-third as long as the middle, rounded lobe.

Inhabiting the boulder-strewn or sandy, but low and marshy shores at points along Ombabika and Orient bays, Lake Nipigon, Ont. The type is our No. 6,944, from the marsh at the head of Ombabika Bay, north end of Lake Nipigon, Ontario, O. E. & G. K. Jennings, Aug. 15, 1914; other collections are 6,633 and 6,636, O. E. & G. K. Jennings, Aug. 6, 1914, and No. 7,001, O. E. & G. K. Jennings, north shore of Ombabika Bay, Aug. 16, 1914. Specimens in Carnegie Museum Herbarium.

ICHTHYOLOGY.—*The fish fauna of the Cordillera of Bogota.*[1] CARL H. EIGENMANN.

The Cordillera de Bogota (or Oriental of Colombia) extends from the equator northeastward to about the seventh degree of north latitude. It is continued northward as the Sierra de Perija to the Sierra Nevada de Santa Marta and northeastward as the Cordillera de Merida to Barquisimeta. The Maracaibo basin lies between the Cordilleras de Perija and Merida. It rises to a height of over 10,000 feet and forms an effective barrier to the intermigration of lowland forms for its entire length from near the equator to the Cordilleras of Perija and Merida. The Cordillera of Perija is the chief barrier between the Maracaibo basin and the Magdalena and the Cordillera of Merida between the Maracaibo and the Orinoco. It contains a series of highland plateaus or parks, of which the Plain of Bogota near its center, with an elevation of about 9,000 feet, is the best known. Its fresh-water fish fauna consists mostly of various species of Astroblepus and Pygidium, three species of Pseudancistrus, a Chaetostomus, and two species of Hemibrycon, all of which are mountain genera, the latter most frequently dipping into the lowland. Two genera, Grundulus and Eremophilus, are peculiar to the highland plateaus. Very few lowland genera and species ascend some distance on the slopes of these Cordilleras. *Farlowella acus* causes some surprise on the eastern slope at 4,500 feet. It is usually found much lower. *Creagrutus magdalenae* and Argopleura cause greater surprise at Alban, at over 7,000 feet. These genera are usually found in much lower altitudes. The greatest surprise is furnished by *Creagrutus beni* at San Gil.

[1] Contribution from the Zoological Laboratory of Indiana University, No. 178. Received July 26, 1920.

It belongs to the eastern slopes of the Andes from the Rio Beni to Central Colombia at least. San Gil at 3628 feet in the Magdalena basin is its only record west of the Cordilleras. No lowland genera or species are found on the heights. So many of the lowland genera and species of the Magdalena to the west of it are identical with those of the Orinoco to the east of it, that it seems very probable that the formation of these young Cordilleras has cut a former continuous fauna in two. Is it possible that the presence of *Creagrutus beni* at San Gil indicates a late route of migration?

Our knowledge of the fauna of the Cordillera de Bogota is based on:

1. The observations of Humboldt during a stay at Bogota.

2. Collections received by the British Museum from different collectors.

3. Collections made by Mr. Manuel Gonzales, my servant during my ichthyological reconnaissance of Colombia in 1912. He collected for me in the Cordillera de Bogota within a radius of a few days riding from Bogota. He gathered specimens in the quebradas along the route from Facatativa on the Plain of Bogota northwestward to Honda on the Magdalena, the western base of the Cordillera. Also along the route northward from Bogota, from Suescum north through Susa, Chiquinquira, Quebrada, Ropero, Guadalupe, Mogotes, San Gil, and Capitanejo in the territory embraced by the Rio Sagomoso and the Rio Suarez and finally southeastward from Bogota along the route from Bogota to Villavicencio.[2]

4. Very valuable collections made for Hermano Apolinar Maria, Director of the Museum of the Instituto de la Salle, on the Plains of Bogota and at the eastern base of the Cordillera of Bogota, at Cumaral and Carneceria. I have received a series of these fishes. Most of the species at Villavicencio, Cumaral and Carneceria more properly belong to the fauna of the Llanos of Colombia and Venezuela than to that of the Cordilleras.

5. Extensive collections were made by myself near Bogota.

[2] Mr. Gonzales also collected at Barrigon on the Meta but this locality is beyond the mountains. Other collections made by Gonzales were unfortunately lost by the carriers after reaching New York.

I. LIST OF ALL SPECIES RECORDED FROM THE CORDILLERA DE BOGOTA

ASTROBLEPIDAE

A family of catfishes of one genus, found exclusively in the Cordilleras from southern Panama and Merida south to Lake Titicaca, from the highest elevation down in places to 300 feet. It has not been recorded from the Plain of Bogota but in all directions from it. The species have a large sucker mouth and a peculiar adaptation to take in water at the dorsal end of the gill slit to pass it out below while they hold fast to rocks with their mouths. The ventrals are freely movable backward and forward, enabling them to hunch forward. They are able to climb vertical and even overhanging walls.

Astroblepus Humboldt.

A. unifasciatus Eigenmann. North and west of Bogota, up to 7,258 feet; also on the Pacific slope in the Rio Dagua.

A. santanderensis E. North of Bogota up to 5,600 feet. Santander.

A. frenatus E. Known from a single specimen. North of Bogota, 6,534 feet. Santander.

A. micrescens E. Principally north of Bogota, sparingly west and east of it. 8,471 feet. It is the principal species of Santander.

A. chotae (Regan). North and west of Bogota. 7,400 feet. South to Ecuador.

A. longifilis (Steindachner). North and south of Bogota. Abundant from Peru to Panama.

A. homodon (Regan). West of Bogota. 7,258 feet. It is the characteristic species between Facatativa and Honda.

A. grixalvii Humboldt. Sparingly west of Bogota. Widely distributed in southern Colombia and Ecuador. The present identification may be questioned.

A. latidens E. Characteristic of the eastern slope east of Bogota between 1,500 and 5,300 feet.

PYGIDIIDAE

A family of South American catfishes with about a hundred species of very divergent habits.

Pygidium Meyen.

Found in all mountain streams of South America from the highest elevations to sea level. Short eel shaped. Bunches of erectile spines on its opercles enable it to maintain itself in the swiftest currents or to hunch itself forward between rocks or to burrow in sand, gravel, or mud.

P. bogotense E. Plains of Bogota to the Santa Marta mountains.
P. venulosum Steindachner. Paramo de Cruz Verde at the eastern edge of the Plain of Bogota. 10,000 feet.
P. stellatum E. Western slope of the Cordillera de Bogota.
P. striatum Meek and Hildebrand. North and west of Bogota. Southern Panama and Rio Dagua on the Pacific slope of Colombia.
P. straminium E. North of Bogota. Santander.
P. nigromaculatum (Boulenger). North of Bogota, to Santa Marta.
P. vanneaui E. Near Honda, west of Bogota.
P. latistriatum E. North of Bogota. Santander.
P. dorsostriatum E. East of Bogota at Villavicencio.

Eremophilus Humboldt.

E. mutisii H. "El Capitan," the only food fish of the plain of Bogota. The genus and species is all but confined to the plain of Bogota. It differs from Pygidium in having no ventral fins. It burrows in the banks and bottom in ponds and rivers.

LORICARIIDAE

A South American family of armored catfishes, principally of the lowlands, a few species ascending to 7,000 feet or more.

Pseudancistrus Bleeker.

Snout granular, with a large sucker mouth and bundles of spines on the interoperculum, both adjustments to torrential conditions.
Ps. setosus (Boulenger). North and west of Bogota up to 7,400 feet. On western slopes only.
Ps. daguae E. East of Bogota and in the extreme west of Colombia. Both slopes of the Andes.
Ps. pediculatus E. East of Bogota. Eastern slopes.

Chaetostomus Tschudi.

Snout naked. A large sucker mouth and interopercular bristles.
Chaetostomus thomsoni Regan. West and north of Bogota up to 7,258 feet.

Farlowella Eigenmann and Eigenmann.

Long slender fishes with no suggestion of adaptations to mountains.
F. acus (Kner). East of Bogota up to 4,500 feet.

CHARACIDAE

A very large family with the widest possible adaptations.

Hemibrycon Günther.

From sea level to 7,000 feet. No particular structural adaptation to high elevations.
H. colombianus E. North and west of Bogota, 4,620 feet. Santander.
H. tolimae E. North of Bogota and widely in the west of Colombia to 7,000 feet.

Creagrutus Günther.

In swift brooks, widely distributed.

C. magdalenae E. West of Bogota. Chiefly in swift lowland brooks.

C. beni E. East and north of Bogota, to 3,628 feet. On both slopes.

Argopleura Eigenmann.

Colombia west of the Cordillera de Bogota.

A. diquensis E. West of Bogota, lowland to 7,258 feet.

POECILIIDAE

Rivulus Poey.

Marine brackish and fresh water. South America to Buenos Aires.

R. magdalenae E. & H. West of Bogota, to 3,372 feet.

II. THE FISHES OF THE PLAIN OF BOGOTA

The Plains of Bogota are drained by the Rio Funza or Bogota which leaves the plateau by the Tequendama falls, 418 feet high. It empties into the Magdalena near Girardot.

The Plains of Bogota (locality No. *1*), at about 9,000 feet elevation, harbor but few species. *Eremophilus mutisii*, "El Capitan," which has elsewhere been recorded only from Chiquinquira, just north of the Plain; *Pygidium bogotense*, which is not distinguished by the local fishermen from the young of *E. mutisii*, extends north to the Santa Marta mountains; and *Grundulus bogotensis*, the "Guapuche", elsewhere taken only in the Quebrada Zuaita, wherever that may be. These three species were found in abundance everywhere I was able to fish.

"El Capitan" is found in the lakes as well as in the streams and the fishwomen in the markets point out lake forms from river forms. There was evidently considerable variation but whether this was correlated with localities I can't say. Three specimens were sent me recently, one of them white, one of them blind, and the third piebald. The specimens suggest that there is a white blind species which at times hybridizes with the normal form.

In addition to the three very common species Gonzales got *Hemibrycon tolimae* at Suescum at the extreme northern edge of the basin of the Rio Funza or Rio Bogota. Steindachner has recorded *Pygidium venulosum* from the Paramo de Cruz Verde at about 10,000 feet. This Paramo lies along the crest

southeast of Bogota. I do not know in which direction, east or west, the stream flows from which it was taken, and I am giving it the benefit of the doubt and am placing it in both lists.

III. THE DISTRIBUTION OF THE FISHES ALONG THE LINE BETWEEN THE RIO SECO NEAR HONDA AND THE PLAIN OF BOGOTA, NEAR FACATATIVA

Specimens were reported from the localities listed below. The longitude is from Bogota. The numbers refer to the species listed below. *1*. Plains of Bogota. See Part II. *2*. Sargento, 4,000 feet, 1, 2, 4, 5, 6, 8. *3*. Guadual, Rio. 1, 2, 4, 5, 6, 8, 9. *4*. Guaduas. Between 0° and 0° 14′ W., 5° 7′ and 6° N., 3168 feet. 1, 2, 5, 6, 7, 12. *5*. Guamal, 1, 2, 4, 5. *6*. Villeta. 0° 24′ 30″ W., 4° 56′ 30″ N., 2,760 feet. 1, 8, 12. *7*. Chimbe. Near Alban. 2, 4. *8*. Alban, 7,258 feet. Formerly Aqua Larga. 1, 3, 4, 6, 8, 10, 11. *9*. Chamisal. Exact locality not known. 4, 6, 9, 12. *10*. Pacho. 0° 5′ W., 5° 2′ 25″ N., 5,893 feet.

The last named locality is not in line with the rest, being northeast of Alban. As far as I am able to locate the localities they run in the order given from Sargento to Alban. There are crests between Sargento and Guaduas and between Guaduas and Villeta. The entire territory drains into the Rio Negro and through it into the Magdalena.

SPECIES TAKEN BETWEEN HONDA AND FACATATIVA

The numbers following the names refer to the localities enumerated above.

1. *Astroblepus homodon*, *2*, *3*, *4*, *5*, *6*, *8*. 2. *A. unifasciatus*, *2*, *3*, *4*, *5*, *7*. 3. *A. micrescens*, *8*. 4. *A. chotae*, *2*, *3*, *4*, *5*, *7*, *8*, *9*. 5. *Pygidium selelatum*, *2*, *3*, *4*, *5*. 6. *P. striatum*, *2*, *3*, *4*, *6*, *8*, *9*. 7. *Pseudancistrus setosus*, *4*. 8. *Chaetostomus thomsoni*, *2*, *3*, *6*, *8*. 9. *Hemibrycon colombianus*, *3*, *9*. 10. *Creagrutus magdalenae*, *8*.[3] 11. *Argopleura diquensis*, *8*.[3] 12. *Rivulus magdalenae*, *4*, *6*, *9*.

IV. THE FISHES OF THE HIGHLANDS OF SANTANDER

Most of the localities in this area, all of them draining into the Suarez and thence into the Rio Magdalena, are small quebradas not given on any maps available.

[3] I have no reason to doubt these localities, especially as the two species were not taken elsewhere by Gonzales. But it is certainly remarkable that they should be found at Alban at over 7,000 feet and not between Alban and Honda.

The first eighteen, Nos. 11–28, are "Astroblepus brooks," probably very swift, from which Astroblepus can easily be caught from under rocks with a dip-net. In these brooks Pygidium has rarely been taken either because it is rare or absent, or because Pygidium is not so readily taken in such streams.

The next eight are preeminently "Pygidium brooks," possibly with pools that could be seined. Pygidium can readily be taken in pools in which Astroblepus would not be found.

Zuaita of this group is notable as containing Grundulus, otherwise only found in the Plain of Bogota.

The most interesting place is San Gil, containing *Creagrutus beni*, otherwise not found west of the crest of the Cordillera of Bogota.

Localities and their location north of the Plain of Bogota, mostly in the Province of Santander

The longitude is measured from Bogota. The numbers following the names of the localities refer to the list of species below.

11. Ducho, Rio, 1, 4, 5. *12.* Labaja, Quebrada, 1. *13.* Callejona, Q., 2. *14.* Charala, Q., near Ocamonte, 2, 8. *15.* Guadalupe, 0° 20′ 42″ E., 6° 2′ 30″ N., 5,400 feet, 2. *16.* Guapota, 0° 25′ 10″ E., 6° 7′ 45″ N., 3,300 feet, 2, 5. *17.* Mogotes, 6° 16′ N., 0° 42′ 42″ E., 5,626 feet, 2, 6. *18.* Pava, Q., 2, 5. *19.* Pelada, Q., 2, 4, 5. *20.* Varriri, Q., 2, 5. *21.* Cabarachi, Q., 4. *22.* San Joaquin. Near San Gil, 6,534 feet, 3, 4. *23.* Densino, Q., 4. 7. *24.* Potrero, Q., 4. *25.* Siachia, Q., 4. *26.* Susa, 0° 4′ 45″ E., 5° 54′ 35″ N., 8,471 feet, 4. *27.* Arguello, Q., 5. *28.* Baipe, Rio Boyaca, 7,400 feet, 5, 14. *29.* Pinchote, 0° 33′ 45″ E., 6° 19′ 25″ N., 4,150 feet, 5, 11. *30.* Ocamonte, 6° 9′ 45″ N., 0° 35′ 35″ E., 4,620 feet, 7, 19. *31.* Honda, Q., 7, 10. *32.* Mango, Q., 7. *33.* Zuaita, Q., 7, 16. *34.* Piedras, R., 8, 19. *35.* Capitanejo, 6° 18′ 40″ N., 1° 0′ E., 3,867 feet, 9. *36.* Raya, Q., 9. *37.* Hato.[4] Between 0° and 1° E., and 4° and 5° N., 4,300 feet, 12. *38.* Ropero, Q., about 5° 43′ N., 12, 15. *39.* San Gil, 3,628 feet, 12, 14, 15, 16, 19. *40.* Suescum, 5° 2′ 25″ N., 0° 11′ E., 7,073 feet, 16, 18. *41.* Chiquinquira, 1° 56′ 45″ E., 5° 32′ 20″ N., 8,626 feet.

It will be noted that only San Gil is credited with more than three species. 13 (Eremophilus) otherwise only in the Rio Funza basin.

[4] There is another Hato near San Gil.

List of the species along the heights north of Bogota with their specific localities by number.

ASTROBLEPIDAE

1. *Astroblepus unifasciatus, 11, 12.* 2. *A. santanderensis, 13, 14, 15, 16, 17, 18, 19, 20.* 3. *A. frenatus, 22.* 4. *A. micrescens, 11, 19, 21, 22, 23, 24, 25, 26.* 5. *A. chotae, 11, 16, 18, 19, 20, 27, 28, 29.* 6. *A. longifilis, 17.*

PYGIDIIDAE

7. *Pygidium straminium, 23, 30, 31, 32, 33.* 8. *P. bogotense, 14, 34.* 9. *P. nigromaculatum, 21, 35, 36.* 10. *P. banneaui, 31.* 11. *P. latistriatum, 29.* 12. *P. striatum, 37, 38, 39.* 13. *Eremophilus mutisii, 41.*

LORICARIIDAE

14. *Pseudancistrus setosus, 28, 39.* 15. *Chaetostomus thomsoni, 38, 39.*

CHARACIDAE

16. *Grundulus bogotensis, 33, 40.* 17. *Creagrutus beni, 39.* 18. *Hemibrycon tolimae, 40.* 19. *H. colombianus, 30, 34, 39.*

V. THE FISHES AND THEIR DISTRIBUTION ON THE EASTERN SLOPE BETWEEN CHOACHI AND VILLAVICENCIO

Localities and their location. The longitude is east from Bogota.

42. Paramo de Cruz Verde.[5] *43.* Choachi, 0° 9′ 40″ E., 4° 32′ 55″ N., 6,200 feet, 1. *44.* Caqueza, 0° 7′ 40″ E., 4° 25′ 15″ N., 5,300 feet, 3, 4, *45.* Fosca, 0° 9′ 15″ E., 4° 20′ 35″ N., 4,500 feet, 2, 3, 4, 7, 9. *46.* Naranjito, 4. *47.* Marcetita, 3 and 4. *48.* Perdices, 4. *49.* Chirajara, 4. *50.* Susumuco, 4 and 8. *51.* Piperel, 4. *52.* Villavicencio, 0° 30′ E., 2° 15′ 10″ N., 1496 feet, 2, 4, 6, 8, 9, 10. *53.* Carneceria, 1, 3, 7. *54.* Rio Rontador, 4, 10. *55.* Tengavita, 4, 8.

The species with their specific localities on the eastern slope are:

1. *Astroblepus grixalvii, 43, 53.* 2. *A. micrescens, 45, 52.* 3. *A. longifilis, 44, 45, 47, 53.* 4. *A. latidens, 44, 45, 46, 47, 48, 49, 50, 51, 52, 54, 55.* 5. *Pygidium venulosum, 42.* 6. *P. dorsostriatum, 52.* 7. *Pseudancistrus daguae, 45, 53.* 8. *P. pediculatus, 50, 52, 55.* 9. *Farlowella acus, 45, 52.* 10. *Creagrutus beni, 52, 54.*

This list gives a glimpse of the fauna of the upper slopes of the eastern face of the Cordillera of Bogota.

Of the localities I have not been able to place the Rio Rontador. The fact that *Creagrutus beni* is found there, places it probably

[5] As stated elsewhere, I am not sure whether this drains to the east or the west. It lies between Bogota and Chipaque on the road to Villavicencio.

near Villavicencio. Tengavita is more uncertain. The fact that it contains *Ps. pediculatus* probably places it near Susumuco and Villavicencio. I have taken Marcetita of the maps to be Marutiba as made out from the labels. Carneceria is a day's journey north of Villavicencio. Villavicencio is given as 150 kilometers from Bogota or about 90 miles. Choachi is directly east of Bogota at a distance of 30 kilometers or 18 miles. Caqueza is 24 miles southeast of Bogota. Fosca is south of Caqueza. The line between Choachi, Caqueza and Fosca is nearly meridional. Naranjito or Naranjal, Marcetita, Perdices, etc., follow each other in order on the trail from Quetame, which is a few miles east of Fosca to Villavicencio.

All of the localities are drained into the Rio Meta and through it into the Orinoco.

There are other species of Pygidium (*metae, kneri*), at Barrigon, at the head of navigation on the Meta and others probably occur in the localities listed.

Of the species taken, *Astrobelpus grixalvii, micrescens* and *longifilis, Pseudancistrus daguae* and *Creagrutus beni* also occur west of the crest.

A. grixalvii is found in streams of southern Colombia to northern Peru. *A. micrescens* in Santander. *A. longifilis* occurs all the way from Panama to Peru.

Pseudancistrus daguae is abundant in the Rio Dagua on the Pacific slope and *Creagrutus beni* is recorded in this paper from Santander.

The one species characterizing the slope is *Astroblepus latidens*, which is known only from this slope, and everywhere on the slope except at Carneceria.

I suspect that the recorded absence of Pygidium from the higher slopes of the eastern side is due to incomplete collecting.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. The abstracts should conform in length and general style to those appearing in this issue.

APPARATUS.—*A new form of vibration galvanometer.* P. G. AGNEW. Bur. Standards Sci. Paper **370.** Pp. 8 (37–44). 1920.

Vibration galvanometers are very useful in a. c. null measurements, but have not been much used in industrial laboratories on account of their being sensitive to external vibrations and requiring delicate adjustments. The present instrument, which has a sensitivity higher than other forms of the moving-iron type, but less than that of the most sensitive forms of the moving-coil type, has the advantages of sturdiness, quick responsiveness, and freedom from the effects of external vibration. It consists essentially of a fine steel wire mounted on one pole of a permanent magnet and so arranged that the free end of the wire may vibrate between the poles of an electromagnet through which flows the current to be detected. The motion of the wire is observed with a microscope.

The "resonance range" is about one per cent; that is, if the frequency of the current is one per cent. above or below the frequency of resonance, the amplitude of vibration will be half as great as at resonance. The sensitivity is such that with a 1-ohm winding an e. m. f. of 3 microvolts may be detected, and with a 270-ohm winding a current of 0.05 microampere can readily be detected. P. G. A.

ELECTRICAL ENGINEERING.—*Leakage resistance of street railway roadbeds and its relation to electrolysis of underground structures.* E. R. SHEPARD. Bur. Standards Tech. Paper **127.** Pp. 39, pl. 1, figs. 9. 1919.

Electrolytic damage to underground piping systems is caused by the escape of current from the rails of electric lines and the resistance of the roadbed is an important factor in the amount of current which may escape.

Short sections of fourteen common types of roadbeds were constructed on the grounds of the Bureau of Standards and resistance measurements under varying weather conditions were carried on for a period of three years. Some measurements were also made on a number of city lines in and about Washington, both open track and several types

of roadbed in paved streets being investigated. Through the co-operation of the United States Forest Products Laboratory at Madison, Wisconsin, measurements were also made on several sections of test track on the Chicago, Milwaukee and St. Paul Railway where railroad ties subjected to several different kinds of preservatives were employed. The results of these measurements are given in tabular and graphical form. E. R. S.

GEODESY.—*A study of map projection in general.* OSCAR S. ADAMS. Special Publication **60**. U. S. Coast and Geodetic Survey Serial **113**. Pp. 24, figs. 15. 1919.

A study of some of the general properties of map projections is attempted in this short publication. The intention is to illustrate in simple form both the difficulties to be met with and the way in which certain properties are attained at the sacrifice of other desirable features. Of necessity there is always a compromise in any given method of mapping, for the spherical surface of the earth cannot be truly represented upon a plane surface. Throughout the whole paper the aim has been to present the considerations in the simplest possible terms, so that the subject matter may be readily intelligible to any reader without the necessity of following intricate mathematical developments or, in other words, the purpose has been to present things in a popular style so that he who runs may read with full understanding. The relatively large number of illustrations should serve as aids in making clear the statements of the text. O. S. A.

GEOLOGY.—*Deposits of manganese ore in Southeastern California.* EDWARD L. JONES, Jr. U. S. Geol. Survey Bull. **710**-E. Pp. 24 (185–208), pl. 1. 1919.

This bulletin describes the manganese deposits in the desert region west of Colorado River, which in 1917 and 1918 yielded over 6,000 tons of high-grade ore and in which at least 30,000 tons is available. The costs of mining, transportation to the railroads, and shipment to furnaces east of Mississippi River are high, and when high-grade foreign ores are available these deposits can probably not be worked at a profit, unless a nearer market can be found.

The manganese deposits occur in veins and brecciated zones in sedimentary and igneous rocks ranging in age from pre-Cambrian to probably Quaternary.

The manganese ore consists of the oxides, of which psilomelane, pyrolusite, and manganite have been determined. Psilomelane is the dominant oxide in all these deposits. It occurs in many forms but most commonly in laminae deposited along the walls of fissures. Psilomelane is more abundant in the surficial ores of the deposits; with increasing depth the softer oxides, pyrolusite and manganite, become increasingly abundant. Associated with the manganese oxides are calcite and subordinately, iron oxides. Calcite is universally present in the ores, though it varies largely in quantity. Quartz was nowhere observed as a primary constituent of the manganese deposits, although the ore generally carries a small quantity of silica from the inclusion of fragments of siliceous wall rock. No manganese mineral other than oxides was recognized in any of these deposits, but none of the workings had passed through the oxidized zone.

The manganese deposits of southeastern California examined in this reconnaissance are similar in type and mineralogy to the deposits in southwestern Arizona, but in each locality the source of the manganese oxides is obscure. However, it seems probable that the manganese oxides are the decomposition product of manganiferous calcite deposited by rising hot solutions in the fissures, or that they were deposited with calcite in the fissures by meteoric waters which obtained the oxides from the decomposition of manganiferous minerals of the surrounding rocks. The evidence for either hypothesis is not conclusive, and definite proof can probably not be obtained until the deposits are explored below the zone of oxidation. R. W. STONE.

GEOLOGY.—*Surface formations and agricultural conditions in the south half of Minnesota.* FRANK LEVERETT and F. W. SARDESON. With a chapter on climatic conditions by U. G. PURSSELL. Minnesota Geol. Survey Bull. **14**: 8–148, map, pls., figs. July, 1919.

This is the third of a series of three bulletins which treat of the surface geology of Minnesota. The first (Bull. 12) deals with the northwest quarter of the State, and the second (Bull. 13) with the northeast quarter. Although published by the State of Minnesota, these bulletins represent results of a cooperative survey between the United States and the Minnesota Geological Surveys.

Each of the bulletins contains a discussion of the physical features and climatic conditions of the entire State. In bulletin 14 a chapter

is given to an outline of the extent and character of each of the drift sheets, the loess, and the alluvium. The detailed descriptions then follow, county by county, and under each county appear tables showing the percentages of each class of land, and farm and crop data, the latter being taken from the reports of the Federal Census of 1910. The percentage of improved land ranges from about 7 per cent in Pine and Crow Wing Counties to over 80 per cent in each of a dozen counties in the south end of the State. The relatively stony red drift of the northeastern part of this area, with its cover of forest and brush, is less attractive to the farmer than the more clayey gray drift of the remainder of the area which is largely in prairie or oak openings. Consequently the red drift has correspondingly slight development. The extent of swamp land is shown for each county, and is found to be much greater in the forested than in the prairie counties. A small map is included to show the distribution of forest and prairie. F. L.

GEOLOGY.—*Nickel deposits in the lower Copper River Valley, Alaska.* R. M. OVERBECK. U. S. Geol. Survey Bull. **712**-C. Pp. 8 (91–98). 1919.

Nickel deposits have been found in the valley of Canyon Creek, a small stream that enters Copper River 6 miles below the mouth of Chitina River. The country rock is light-gray limy and quartzose schist, into which peridotite has been intruded. The peridotite is rather strongly mineralized in places with sulfides, with which the nickel is associated. The peridotite is highly altered and coarse grained. 16 nickel claims have been located, but very little development work has been done. At present, the known nickel deposits of Alaska probably could not compete on the basis of nickel content alone, with the deposits of Sudbury, Canada. R. W. STONE.

GEOLOGY AND HYDROLOGY.—*Ground water in the San Jacinto and Temecula Basins, California.* GERALD A. WARING. U. S. Geol. Survey Water-Supply Paper **429**. Pp. 113, pls. 14, figs. 15. 1919.

Observations on the ground-water level during 1904–1916 are given, with mention of the relation of the changes in level to rainfall and to irrigation development. Areas of flowing artesian wells are outlined, and the possibility of obtaining flows in other localities discussed. Analyses of well waters are given, with a discussion of their use and adaptability for irrigation. A map (Pl. III), shows the general geology

to consist of ancient igneous and metamorphic rocks, overlain on the lower slopes by clays, shales, and gravels of early to late Tertiary age. The valley lands are covered with sandy soils, chiefly derived from alluvium. A chapter on pumping tests, by HERMAN STABLER, contains tables of value in determining the proper size of pumps and prime movers for specified lifts, and acreages to be irrigated.

G. A. W.

GEOLOGY AND HYDROLOGY.—*Ground water in Reese River Basin and adjacent parts of Humboldt River Basin, Nevada.* GERALD A. WARING. U. S. Geol. Survey Water-Supply Paper 425-D. Pp. 35 (95–129), pls. 6, fig. 1. 1918.

Reese River drains a long, narrow basin in central Nevada, and flows northward to Humboldt River near Battle Mountain. The region has long been devoted to stock-raising, but there is possibility of increasing the present areas of hay lands, irrigated by flood water, by developing ground water for irrigation. There are well-developed alluvial fans along the valley borders, and several playas (dry lakes), in the lower parts of the valleys. A geologic map (Pl. VIII), based on the work of the Fortieth Parallel Survey, shows the mountains to consist of ancient granitoid rocks and Tertiary lavas, with sedimentary rocks of Paleozoic and Mesozoic ages. In the valleys there are Tertiary lake deposits in addition to Quaternary lake and stream materials.

G. A. W.

HYDROLOGY.—*Southern California floods of January, 1916.* H. D. MCGLASHAN and F. C. EBERT. U. S. Geol. Survey Water-Supply Paper 426. Pp. 80, pls. 17. 1918.

The 1916 flood, especially in San Diego County, Calif., was probably the maximum since 1862. For nearly a month San Diego was practically cut off from communication with the rest of the State, except by steamer.

The important feature of this report is the very complete record of precipitation and run-off. Rainfall records, covering the flood period, are given for 156 points well distributed throughout this limited area, complete monthly records for San Diego, Los Angeles, and Santa Barbara, and a discussion of the intensity and distribution of rainfall in southern California. There are complete records of daily discharge for nearly all of the important streams, and tables of crest discharges and run-off summaries which give drainage areas, run-off per square

mile, mean rainfall, and depth in inches on drainage areas. The complete base data are published in order that independent studies may be made in greater detail. For purposes of comparison, there are records and information covering all floods since the country was first settled. H. D. McG.

RADIOTELEGRAPHY.—*Airplane antenna constants.* J. M. Cork. Bur. Standards Sci. Paper **341**. Pp. 14, figs. 12. 1919.

This paper contains data observed by the writer while an officer in the Signal Corps, U. S. Army, and is published by permission of the Chief Signal Officer. The purpose of this work was to devise a method for measuring airplane antenna constants (*i. e.*, capacity, inductance, natural wave length) under conditions of actual flight; and to use this method to obtain data on various forms of fixed and trailing wires.

The principle of the method involves a continuous wave oscillator feeding directly into the antenna and substituting for the antenna a variable calibrated condenser and adjusting for the same wave length as with the antenna in the oscillating circuit. The result obtained is the effective capacity of the antenna. Having found this, a variable calibrated non-inductive resistance is varied until the D. C. component of the plate current reads the same as for the real antenna. This gives the effective antenna resistance. Knowing the effective values of capacity at various wave lengths, the true capacity, inductance and natural wave length are readily found.

By this method results were obtained with various forms of fixed wires, and one, two and four trailing wires of various lengths, are summarized.

A method for finding the directional transmitting effect of various antennas is also described. In order to compare the amounts of energy received, a detector tube with a three-stage audio amplifier is used. A transformer is placed in the plate circuit of the last amplifier tube, the secondary of which is connected to the heater coil of a thermocouple connected to a D. C. micro ammeter. This when calibrated is free from many of the uncertainties of the ordinary audibility meter. A typical directional curve of the trailing wire antenna is included in the paper. J. M. C.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY OF WASHINGTON

827TH MEETING

The 827th meeting was held at the Cosmos Club, January 3, 1920, with President SOSMAN in the chair and 55 persons present.

Mr. ENOCH KARRER presented two papers, the first being on *Diffusion of light along a searchlight beam.*

The importance of the light diffused along a searchlight beam is pointed out. It aids in the directing of the beam, and makes it possible to use searchlight beams as land marks for service on land and in the air and perhaps as beacons in the lighthouse service. On the other hand, this diffusion means loss of light and interferes with the discerning of the target from positions near the searchlight. Data on the brightness of the diffused light for various angles along the beam were given as well as data on the per cent of plane polarized light in the diffused light. An explanation was offered of the apparent ending of the searchlight beam, and of the curving of it under certain conditions.

Discussion: The paper was discussed by Messrs. CRITTENDEN, HUMPHREYS and SOSMAN.

Mr. KARRER'S second paper was on *The contrast sensibility of the eye under low illumination.*

Data on contrast sensibility were given that were obtained under conditions simulating those that actually obtain in the use of searchlamps. An illuminated strip was projected on a field of known brightness. The length of the strip was increased from zero to a length just visible to the observer. The results obtained are expressed by curves showing the relation between (1) strip length (visual angle) and field brightness, for constant contrast between strip and field; (2) strip length and contrast between field and strip, for constant values of field brightness. These curves lie in groups consistent with each other, and those obtained for two observers are similar. Examples were given of how these data together with the data on diffused light may be applied.

Both of the above papers were illustrated by lantern slides.

The next paper was by Mr. F. E. WRIGHT, on *The contrast sensibility of the eye as a factor in the resolving power of the microscope.*

In this communication attention was directed to three factors which are of importance in high-power microscope work, namely: (*a*) The use of a polarizing prism to eliminate that part of the field light which

does not contribute to the diffraction pattern in the image and hence tends to reduce the contrast and to decrease the sharpness and crispness of the image. This phenomenon arises because diffracted beams which emerge from gratings whose interval is of the order of magnitude of half a wave length of light, are sensibly polarized in a plane normal to the lines of the grating. (*b*) A diaphragm of the rectangular type is recommended for use in the image plane of the eyepiece in order to cut out all light except that from the particular object under examination. This device allows the eye to work at best efficiency because it is not disturbed by extraneous light provided, of course, the field of view covers an angle of 10 degrees or more. (*c*) The importance of a field intensity of illumination approaching that of daylight and best adapted for the eye at any particular time is emphasized; the simplest method for securing this is by means of a substage polarizer in conjunction with the polarizing prism; the polarizer can be rotated and with it the intensity of illumination of the field varied. These factors are not important for ordinary observations because the resolving power there required is not great; but in high-power, critical work they are significant and enable the observer to accomplish with comparative ease that which under other conditions is a matter of difficulty.

Discussion: At this stage Mr. KARRER's second paper and also that of Mr. WRIGHT were discussed, Messrs. CRITTENDEN, SOSMAN, HUMPHREYS, and LITTLEHALES participating in the discussion.

The last paper of the evening was by Mr. L. A. BAUER, on *Further results of observations of the solar eclipse of May 29, 1919.*[1]

A complete series of photographs of the solar eclipse of May 29, 1919, taken by the various astronomical expeditions (Smithsonian Institution at La Paz, Bolivia; Rio de Janeiro Observatory at Sobral, Brazil; and British at Sobral and Isle of Principe, Africa; and the geophysical expeditions of the Department of Terrestrial Magnetism, at Sobral, Brazil, and Cape Palmas, Liberia) was shown. It was shown that the type of the corona was approximately of the intermediate type between that which is seen during years of minimum sunspot activity, when there are great equatorial extensions of the corona, and that shown during years of maximum sunspot activity, when streamers of about the same length extend from the sun in every direction.

The great red prominence seen at the author's station (Cape Palmas, Liberia), on the southeast limb of the sun turned out to be the largest prominence thus far photographed. At the time of totality it was about 100,000 miles high and had a base of about 300,000 miles. With the aid of the data supplied by the Yerkes Observatory it was found that the mean heliographic latitude of the prominence during the eclipse was about 18 degrees south, and on the east limb. With the aid of measurements on the various photographs, the mean heliographic latitude of the pronounced V-rift in the solar corona on the west limb turned out to be about 45° degrees south. Practically diametrically opposite was a less-pronounced rift somewhat in the shape of the letter U.

[1] This JOURNAL 10: 112. 1920.

In conclusion, graphs were thrown on the screen exhibiting the deflection of the rays of light as shown especially by the observations made by Dr. A. C. D. Crommelin of the British party at Sobral. The detailed data as well as a photograph showing the deflected star images had been courteously supplied the author by the Astronomer Royal, of England, Sir FRANK W. DYSON, in time to be presented at the meeting.

Discussion: Mr. BAUER'S paper was discussed by Messrs. HULL and HUMPHREYS.

828TH MEETING

The 828th meeting was held at the Cosmos Club, January 17, 1920, President SOSMAN presiding and 35 persons present.

The program was devoted to the general subject of *Physical laboratory methods applied to aircraft power plants.*

The first paper was by Mr. D. MACKENZIE on *The velocity of flame propagation in gas-engine cylinders.*

For many years automotive engineers have discussed the probable velocity of the flame in the compressed and burning gas in the cylinder of an internal combustion engine. Many have maintained that this velocity was comparatively low and that in a high speed engine, in order to obtain maximum efficiency and power, at least two spark plugs must be used. It has been maintained by these engineers that by igniting the mixture at two points in the cylinder, the necessary time for complete combustion would be greatly reduced as compared with that needed when but one spark plug is used. However, until very recently, no measurements have been made in an actual engine and the determination of this velocity has always been considered to present extreme difficulties.

For several months, the Bureau of Standards has been investigating this subject. A single cylinder gasoline engine, the combustion space, valves, piston, etc., of which are identical with those used on the Liberty aircraft engine, has been employed in this work. Three spark plugs are placed in the cylinder; the first is used to ignite the charge and is connected to the regular ignition system of the engine, the other two plugs are connected at approximately the proper time to a source of direct current, the voltage of which is insufficient to break down the gap between the sparking points of the plugs while under compression, but which is sufficient to cause a spark to pass as soon as ionization of the gap occurs, due to combustion of the surrounding mixture. These spark plugs are so connected with an oscillograph that the time when the flame reaches them is recorded on a strip of photographic film. The distance between the plugs is accurately known and the speed of the oscillograph film is also easily determined. It is obvious, therefore, that by measuring the distance between the points on the film indicating discharge of current across the gaps, the average speed of the flame between these points may be measured.

Determinations have been made of the velocity of flame propagation under many conditions of fuel-to-air mixture ratio, compression, speed, etc. The velocity appears to vary greatly under different conditions and to increase as the flame spreads through the combustion space.

The paper was illustrated by lantern slides.

Discussion: The paper was discussed by Messrs. HAWKESWORTH, WHITE, HUMPHREYS, SOSMAN and JAMES.

The second paper was presented by Mr. S. R. PARSONS on *Cooling radiators for aircraft engines*, and was illustrated by lantern slides.

Airplane radiators absorb engine power because of air resistance and weight, and the most efficient radiator will dissipate heat at the required rate with a minimum absorption of power.

For the high rates of flow of water used in aeronautic practice, heat transfer under given conditions of temperature and air flow is practically independent of the rate of water flow; but the heat transfer is largely influenced by conditions of the flow of air through the radiator, and is found under given temperature conditions to be practically definite for a given *mass flow* of air, whatever combination of density and linear velocity produces that mass flow. The individual air streams passing through the air tubes of cellular radiators appear to show turbulent flow, and spiral vanes or other devices for increasing turbulence, while they may increase the heat transfer, result in every case tested at the Bureau of Standards in decreased efficiency, because of a disproportionate increase in air resistance. High thermal conductivity is of negligible importance in the thin metal walls separating water passages from air passages, but is of some importance in projecting "fins." Highly polished surfaces dissipate heat more rapidly than surfaces only ordinarily smooth.

Air resistance is caused by impact on the front face of the radiator, skin friction in the air passages, and suction on the rear face, the relative importance of the three parts varying widely with different types of construction. Skin friction appears to follow roughly the laws for long tubes. For minimum air resistance, straight and smooth-walled air passages are essential, for anything that deflects the course of the air adds considerably to the resistance. The effects of forms of entrance to and exit from the air passages are of importance, but are not well worked out.

Conditions giving maximum mass flow of air through the radiator, and *to that extent* tending to increase heat transfer for a given flying speed, are identical with those giving minimum air resistance.

Radiators for use on planes flying at the higher speeds should be characterized by straight and smooth-walled air passages, and minimum obstruction of frontal area for a given amount of cooling surface.

The discussion is directly applicable only to radiators in "unobstructed" positions on the airplane, where other parts of the structure do not affect the flow of air through the radiator.

829TH MEETING

The 829th meeting was held at the Cosmos Club, Jan. 31, 1920, with President Sosman presiding and 42 persons present.

Prof. W. J. HUMPHREYS, retiring President, delivered an address on *A bundle of meteorological paradoxes*. The paper was discussed by Messrs. ABBOT, KIMBALL, BAUER, PAWLING and BROOKS. It has been published.[2]

D. L. HAZARD, *Corresponding Secretary.*

[2] This JOURNAL 10: 153. 1920.

NOTE.—I regret that ignorance of the prior publication of Föppl[1] on the fundamental polyhedron of the diamond lattice prevented me from giving due credit to him in a recent note[2] on that subject.

ELLIOT Q. ADAMS.

Bureau of Chemistry.

[1] LUDWIG FÖPPL. *Der Fundamentalbereich des Diamantgitters.* Phys. Zeitschr. 15: 191–193. 1914.

[2] ELLIOT Q. ADAMS. *Note on the fundamental polyhedron of the diamond lattice.* This JOURNAL 8: 240–241. 1918.

SCIENTIFIC NOTES AND NEWS

DR. C. WYTHE COOKE has returned to the Geological Survey from private work in Colombia.

MR. A. E. FATH, geologist in the oil and gas section of the U. S. Geological Survey, has taken furlough for three months to engage in private work in foreign lands.

Mr. CHARLES S. HOWARD, formerly instructor in electrical engineering and physics at the U. S. Naval Academy at Annapolis, has been appointed junior chemist in the quality-of-water division, of the Water Resources Branch, U. S. Geological Survey.

Dr. JOSEPH PAXSON IDDINGS, formerly professor of petrology at the University of Chicago, and until recent years geologist with the U. S. Geological Survey, died at his home at Brinklow, Maryland, on September 8, 1920, in his sixty-fourth year. Professor Iddings was born at Baltimore, Maryland, January 21, 1857. He entered the Geological Survey as assistant geologist in 1880, shortly after its foundation, and retained his connection therewith while professor at Chicago in the years 1892 to 1908. Since 1908 he had devoted his attention entirely to independent petrologic and geologic work. He was the author of two text-books and many papers on the mineralogy and petrology of the igneous rocks. He was a member of the ACADEMY and of the Geological Society of Washington.

Mr. PAUL MOORE, Director of the Information Bureau of the War Trade Board, has been appointed Secretary of the Division of Research Extension of the National Research Council.

Dr. F. HASTINGS SMYTH, formerly captain in the Chemical Warfare Service, joined the staff of the Geophysical Laboratory, Carnegie Institution of Washington, in September.

Dr. SAMUEL MILLS TRACY, agronomist with the U. S. Department of Agriculture, died on September 5, 1920, in his seventy-fourth year. Dr. Tracy was born at Hartford, Vermont, April 30, 1847. He was professor of botany and agriculture at the University of Missouri from 1877 to 1887, director of the Mississippi Agricultural Experimental Station from 1887 to 1897, and was appointed special agent in forage crop investigations with the U. S. Department of Agriculture in 1897. His research work was specially directed to the botany of the Southern States.

A new "division of non-ferrous metallurgy" has been created in the Bureau of Mines. Mr. A. E. WELLS, of the Bureau's staff, has been placed in charge. The headquarters of the division will be at Salt Lake City, Utah.

Mr. R. M. WILHELM, chief of the thermometer laboratory of the Bureau of Standards, resigned in September to accept a position with the C. J. Tagliabue Manufacturing Company, of Brooklyn, New York, manufacturers of thermometric apparatus.

MR. W. P. WOODRING and a party from the U. S. Geological Survey have left for Haiti to conduct a reconnaissance geologic examination of the Republic of Haiti at the request of that government.